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Eng 1815.79

THE

# WORLD'S

# NAVIGATION:

## The Problem

OF

# RIVER MOUTHS.

A NEW POWER, TO BE EMPLOYED AS AUXILIARY TO THEIR IMPROVEMENT.

BY G. T. STACKPOLE, FARMER, ILLINOIS.

BLOOMINGTON, ILL.:
THE PANTAGRAPH PRINTING ESTABLISHMENT.
1879.

Eng 10.15.79

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A NEW POWER, CLAW AND IMPLEMENTS ADAPTED TO THEIR IMPROVEMENT.

BY W. J. STACKPOLE, FARMER, ILLINOIS.

BLOOMINGTON, ILL.:
THE PANTAGRAPH PRINTING AND STATIONERY CO.
1879.

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Eng 1818.79

THE

# WORLD'S

# NAVIGATION:

The Problem

OF

# RIVER MOUTHS.

A NEW WORLD-PLAN [illegible] ANALYSIS OF THEIR [illegible]

[illegible]

BLACKBURNE, [illegible]
THE [illegible] PUBLISHING ESTABLISHMENT.
1879.

THE

# World's Navigation.

THE

## PROBLEM OF RIVER MOUTHS.

A NEW FORCE, PLAN, AND IMPLEMENTS, ADAPTED TO THE IMPROVEMENT OF RIVER MOUTHS: AS THE DANUBE, MISSISSIPPI, VISTULA, ELBE, LA PLATA, COLUMBIA, ETC.; AND FOR SEA-COAST AND INTERIOR CHANNELS, BARS, AND SHOALS; AND FOR EFFECTIVE, RAPID AND ECONOMIC IMPROVEMENT OF ALL EARTH OBSTRUCTED CHANNEL-WAYS.

By W. T. STACKPOLE, FAIRBURY, ILLINOIS.

BLOOMINGTON, ILL.:
PRESS OF THE PANTAGRAPH.
1879.

Eng 1018.79

Harvard College Library
Aug. 14, 1916.
Bequest of
Erasmus Darwin Leavitt.

# INTRODUCTION.

In printing and presenting this communication, the writer is prompted and encouraged by the hope of practical results, and wide public benefits through improved navigation—ocean and inland—not less than by personal considerations, and he is cheered by the belief of many, as to the necessity and propriety of this course; and especially, and recently, by the events that have transpired, and by the opinions of eminent men.

The means proposed for accomplishing the long needed work, in its first inception, came to him early in 1874, while laboring to aid the attempt to revive our navigation and promote sound national policies; and from the first it met (as now) the high approval of some distinguished men of national reputation, as well as of many citizens and friends. And from the first also it awakened in his own mind and heart, complete faith in future results; faith since matured (under the most adverse circumstances) by careful and laborious examination for years, and also an examination of the most powerful dredgers in the world, and of the subject at large. But various good and proper reasons—both public and private—have required that it be held in abeyance until the result of other work was known. That time appears now to have arrived. Moreover, a great benificent event in this hemisphere and the world seems about to dawn, when all our interests are so greatly suffering. For now at last, in the Grand Providence of events, the time seems near when France, having opened the great *Eastern Gate* for the world's navigation, is about to open the *Western Gateway*, by constructing the "American Inter-Oceanic Ship Canal," at or near the Isthmus of Darien. This should greatly advance the general economy of navigation throughout the world, and extensive, rapid, and cheap improvement of natural channels is required.

And hoping now very earnestly for the kindly and just consideration and approval of the engineers of the United States, whose skill and fame are known throughout the world, and for the favorable consideration and action of the Congress of his country, and the approval of its people, he would beg leave to submit the annexed brief general view or outline of the subject, and also some specific details as to the work required, and the forces and implements proposed.

Very respectfully,

W. T. STACKPOLE.

FAIRBURY, Ill., Feb. 14, 1879.

# NAVIGATION:

## THE WORLD'S NEED OF ITS IMPROVEMENT.

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## "THE GATES OF THE RIVERS."

THE PROBLEM OF THEIR OPENING CAN ONLY BE SOLVED BY THE USE OF IMPROVED IMPLEMENTS AND NATURAL FORCES EXISTING IN ALL WATERS.

The work at the mouth of the Danube, it is at length known, is wholly inadequate to admit heavy shipping into that great river. And so at the mouth of the Mississippi. And so at the mouth of the Vistula, the Rhone, and many other important rivers where improvement with that purpose has been attempted. We might almost say all other rivers are barred at their mouths, unless cleared by frequent artificial aid, or by extraordinary natural conditions. This fact has not seemingly been fully realized by the general public, (if clearly stated) and even the faithful, extended and elaborate labors of engineers at river mouths, in Europe and America, have often, if not usually, seemed to deal with such questions as the mouth of the Mississippi as though it was anomalous and extraordinary, and only to be understood by peculiar illustrations. For example, one learned engineer argues, in an official report, that "the Gulf of Mexico is too large" for the Mississippi, and too large to admit ot keeping the mouth of the river open for heavy shipping. Another declares that "in order to understand the question it is necessary to realize that the river is leveling the continent, and carrying it down to the gulf."

Do such extravagant statements indicate clear conceptions of nature, and of the work required of man? Are they wise, or absurd? And great works (called permanent) are proposed, radi-

cal changes in the river planned, and various and more various, and more costly, become the theories and schemes brought forward, and urged with all the zeal of great talents, concentrated on a single object, and backed by a great public necessity. And there are also great sets of different interests; some anxious to honestly accomplish the object, and improve navigation, and others, (misguided in their aims) secretly wish to defeat it, and therefore will prefer an impracticable theory to a sound and effective plan. And so doubtless in Europe.

But where is the sound plan, among all brought conspicuously forward, and certainly all rightly offered are entitled to just consideration?

If we ask the engineers of Prussia, they will tell us that more than a hundred and fifty years of effort, by various plans, including jetties, a canal, and ordinary dredging, have gained only a moderate degree of success at the mouth of the Vistula; and they will point to the splendid city of Bremen, once so wealthy and prosperous, now in a sad and sorrowing decline, through the shoaling of the Weser, and the increased size of shipping. So Hamburg and Antwerp are sufferring greatly, and in danger, and so are several of our cities, including even New York; indeed we may justly include our whole country in the effects of bars at the mouths of two rivers. And so at the river mouths of famine-stricken China and India, and probably the harbors of Persia. So in the vast rivers of South America, with its great systems of mighty rivers. Even at Buenos Ayers, where La Plata is thirty-six miles wide, vessels drawing only sixteen feet, must lay off seven or eight miles, and receive and discharge cargoes by means of lighters. Here jetties would be lost. And so the mouths of the African rivers are barred like those of Europe, Asia, and America; and of course wholly unimproved because backed by a savage wilderness.

So too on our Pacific coast, where the noble Columbia, CLEAR as any river on earth, very deep, and twelve miles wide at its mouth, and bearing the poetic, historic name of our country—is obstructed by a great bar, a sea coast bar, which the ocean has thrown completely across it. And who would venture to apply jetties there? The very suggestion would awaken derision. And

yet the river does not seem to be "leveling the continent" to any great extent by the flow of its clear waters.

That work everywhere was done long ago by the Great Supreme, the Creator of all worlds, and done before man's tasks began; and mighty indeed were the forces used. The record of that work remains in different and varied forms. And so too do the *natural forces remain*, in subdued and modified forms, awaiting man's use.

And perhaps a statement, a clear brief statement of our problem is somewhere given, and a prophecy of its solution. Is the time at hand? And why should it be unreasonable to believe, that implements, adapted to general work, in full conjunction and harmony with general natural forces, should be devised, and that with them, and the natural forces, the necessary work should be accomplished and maintained? And is it not also reasonable to believe that upon the whole, the world's need of a solution of these problems is greater now than it has ever been? All the great governments of the civilized world seem to have sought their solution, more or less, in some way for centuries, and especially since the eventful year 1848, and most of all, quite recently, perhaps at this very time.

Everywhere, now, the world's navigation is crippled or embarrassed, and hence all legitimate business and labors must suffer, and loss of property, debt, bankruptcy, foreclosure of mortgages, poverty and want, are increased far and wide, by this weakness in the right hand of commerce.

Of course, other causes exist and exert a mighty force, and appeal loudly to our patriotic statesmen, but the great office of navigation, has never been denied. And probably, in the last seven years, FAMINE has destroyed more human lives than in any other similar period on the earth. And of human instrumentalities, nothing, short of improved navigation and land transportation, brought forward and extended by the Christian nations, can banish it from the earth.

And it is the high duty of man to rightly labor, and to rightly use the earth's treasures and resources. So unobtrusive kindness, gentle charity, and relieving the suffering, are placed by the Great Teacher in the front rank of human virtues. Hence,

modern civilization has found its noblest triumphs in utilizing the forces and resources of nature for man's use and advancement; and here our country has filled many a bright page in the record of modern times.

And after such an amazing record of industrial triumphs, and varied productions of art and nature, and such a vast surplus for export for human needs, brought from the rich bosom of the teeming earth by intelligence, labor and fortitude,—after all this, and long after the gift of Washington and his compatriots, *can it be* that partisanship, sectionalism, and demagogism in politics, and hypocrisy in religion, aided by rank treachery to our institutions, gross incompetence, and remorseless external influences, are to conduct our people to the graves of paupers and bankrupts? Shall patriotism give way to partisanship, and then both to influences emanating from feudal interests in another land? Influences that must still for a time deceive, mislead, and overreach nations; and that never yet knew remorse, and rarely defeat, and the instruments of whose diplomacy and aggrandizement, are often bribery, secret treachery, and low disgraceful intrigues, as all history proves; and these are joined with most skillfully organized violence, more dangerous than that of ancient Rome, because more perfidious, and often using others to fight its battles. But though crippled, we can still labor, and one of the present high duties upon us is the revival and improvement of navigation, especially *our* navigation on seas and rivers, which is interlocked also with the world's problem.

And is the task really so great, in comparison with the objects to be gained by its performance, and with the means and natural forces adapted to its reasonable fulfillment?

The bars and shoals we have named are in their extent but as a trifle to the deep waters near each. And so with the bars on the English coast, where vessels are lost by thousands. So also with the bars in our rivers, and at the mouths of small creeks. Everywhere the natural forces that slowly form them, are right at hand, and available for their rapid reduction, to the reasonable extent required for the best practical results in navigation. The extent of work required should never be underrated, nor its difficulties denied; but the tendency is to overrate, partly because of

the magnitude of the subjects, and sometimes of surrounding objects. Especially is this the case on the shore of the ocean, whose power of course is beyond man's control, and impresses the mind with awe. Man can never approach it as a master, for dominion over it was never given to him. But he can approach it as a friend, and its murmuring waves may assist his labors, though they seem to *destroy about all attempts at permanent and purely artificial works to resist their force;* and this on all coasts, and in all time.

In almost all cases, coast and interior, where boats and vessels are most liable to get "aground," the impending shoal is scarcely more than an atom, as compared with the deep water near; rarely so much in proportion as a fine thread to the breadth of a man's coat. Nor does it, if a bar, often require removal, but only a deepened channel way over it. And if a wide and extensive shoal or flat, as in Mobile Bay, then certainly this is all that is required.

Doubtless the bar often fulfills an important and necessary office, and in such cases its complete removal, even if practicable, might be highly injurious, and should not be attempted. Tree Top bar, in the Illinois river, was formed originally by a tree lodging in the channel, obstructing the natural flow of the water and drift, catching sediment and various floating material, and so forming in time the very worst bar in the whole river. The complete removal of such a bar, (if required) would be entirely practicable, and the result no doubt would be permanently beneficial. And so with *many* other bars—*the results of neglect to clear channels of slight obstructions.*

On the other hand, the low land spits that form the banks of the "passes" of the Mississippi, could not resist the great forces of the sea, unless protected by those outworks we call "bars," and through which we need a deepened channel way, sufficient for heavy shipping to safely pass without grounding. This will do, though it may be found advisable to go yet deeper in sweeping out a channel, (which does not need to be very wide) in order to allow under currents, from sea and river to exert themselves, under the varying forces of the sea and river, the oscillations of the tides, &c.

But with the dredging apparatus used heretofore, tests of this kind could not be made, as they were unable to work even deep enough for the heaviest ships. Nor could they call into action the natural forces resting in the water where they worked, as their power was expended in *digging*.

The McAllister and Essayons were probably as powerful and efficient dredgers as ever were built for improving a river mouth, they were under command of good officers, and the results they gained were good, and do not appear to have been surpassed. But they attempted a heavy cut. Hence their motion (of the steamer's hull) must of necessity be slow, and admit of little or no gain from the momentum. So, too, their pathway must be narrow, and the results achieved must not only be won entirely by mechanical power, but that must be exercised under many adverse and embarrassing circumstances. And of course no form of bucket dredging could be adequate for similar reasons. The whole plan and mode of operations must be entirety different, in order to gain the great, desired, and necessary results.

For ages, volumes on volumes have been written by able engineers, detailing most faithfully the various bar and coast formations of Europe, including Russia and Great Britain. Currents, rivers, and tidal forces have been studied, and lives upon lives devoted to labors and researches looking to accomplish the improvement and deepening of the earth-obstructed channel-ways of navigation. Let us hope these labors may not be lost, but rather be crowned with full success. And so here in the United States, where now, (owing to the pressure of a great necessity) the conflict of theories and plans has now broke out afresh, and is now going on vigorously, and judging by the great history of the past, may last for several generations, with vast expenditure, and with very inadequate results. (See Appendix.)

But there is good reason, and reasonable evidence for believing, that sufficient results may be satisfactorily won by judicious use of improved apparatus and implements for work adapted to existing natural conditions; and used in full harmony and correspondence with the natural forces found in all waters, in all localities, and at all times. A very old, yet practically *a new force* never yet used, awaits our use. The modes and appliances pro-

posed have long since met the approval of many citizens and friends of the inventor, and of some eminent men of national reputation. And there seems reason to believe that the present occasion to bring them forward is as timely as the necessity is urgent.

For these reasons, he would beg leave to submit their claims, asking only that just consideration, to which all are entitled, and quite willing that they should stand by the test of merit, asking only "a fair field and no favor," save such as equity and right would award.

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## CAPACITY FOR WORK.

Below is given estimate of work of steamer for heaviest service, as at the mouths of the Mississippi, Danube, Columbia, Yang Tse Kiang, approaches to Buenos Ayers, New York, Hamburg, Bremen, &c. Power same as the McAlister—1800 horse.

LENGTH OF PLOW BEAMS, 62 FT.—SPEED, 3 MS. PER HOUR.

| | *Cubic yds.* |
|---|---|
| On removal of 1 inch in depth at a passage, 1 hour's work | 3034 |
| " 2 " " " 1 " | 6068 |
| " 4 " " " 1 " | 12136 |
| " 6 " " " 1 " | 18204 |

LENGTH OF BEAMS, 62 FT.—RATE OF SPEED, 5 MS. PER HOUR.

| | *Cubic yds.* |
|---|---|
| On removal of 1 inch in depth at a passage, 1 hour's work | 5040 |
| " 2 " " " 1 " | 10080 |
| " 4 " " " 1 " | 20160 |
| " 6 " " " 1 " | 30240 |

LENGTH OF BEAMS, 62 FT.—RATE OF SPEED, 7 MS. PER HOUR.

| | *Cubic yds.* |
|---|---|
| On removal of 1 inch in depth at a passage, 1 hour's work | 7056 |
| " 2 " " " 1 " | 14112 |
| " 4 " " " 1 " | 28224 |
| " 6 " " " 1 " | 42336 |

## COSTLY MEANS:

TRIED FOR AGES, AND NOW KNOWN TO BE INADEQUATE. AN INVENTION FOR USING A GREAT NATURAL FORCE NOT YET USED.

The means heretofore used to improve, or attempt improvement of river mouths, channels, &c., (obstructed by earthy deposit,) may be divided into three classes, as follows:

First, dredging; second, jetties, dikes, wing dams, &c.; third, a canal or artificial mouth, or channel.

The discussion of the second of these modes, has of late been quite general, and the most conspicuous examples are the great river of Europe, and the great river of our country, and of both the result is now known to be inadequate.

Of the third, though much discussion was had as to the St. Phillip canal, and an application at the mouth of the Vistula, and perhaps elsewhere, may sometime have been made, yet no marked and adequate success at the mouth of any great river appears.

The first, dredging, appears always to have met with a fair or reasonable degree of success in proportion to the means used; and it may be divided into two classes.

First, the ordinary and varied means of lifting the earth from the bottom, and removing it away in boats or otherwise. This work has always been successful in various forms of dock and harbor improvements, for which it is peculiarly adapted, and is extensively used. But its cost, its slowness of operation, the inability to work in unsheltered or exposed situations or rough water, the difficulty of working in water of any considerable depth, and the impossibility of accomplishing great and general results in a short period of time, and at a moderate cost, all combine to preclude the use of it for extended and ample work in improving the great channel-ways of navigation.

The other class of dredging, sometimes referred to as "stirring up," is probably illustrated best by the Essayons and McAlister, great dredgers, built for the United States government, and

claimed in official reports of United States engineers—on St. Philip canal—to be the most powerful in the world.

They are each provided with a "digger" or propellor twelve feet in diameter, which digs deeply and rapidly in the mud and throws it by mechanical power upward in the superincumbent water. When circumstances are *most favorable*, we may allow five thousand feet as the distance made per hour—a cut three feet deep in center, and eighteen cubic feet excavation for each foot lengthwise cut. Hence ninety thousand cubic feet, or three thousand, three hundred and thirty-three cubic yards might be excavated per hour and thrown into the superincumbent water to be borne away by its flow.*

But the writer, when visiting these vessels in July, 1875, proved by a bucket full of water taken at his request, by order of Capt. Elwell, from directly over the digger of the McAllister when at work, that the *excessive churning* of the water by the rapidly revolving digger, together with the *overload* thrown upon so limited a space or surface, causes a very rapid precipitation of the sediment, far beyond anything ever seen in such water elsewhere, and that he would not have thought possible. Hence much of her work would of course be lost. Though this is but a minor objection as compared with others that need not be here enumerated. But the great feature is that the work is *not correspondent with the natural force resting almost unused in the water*—a latent force adapted by nature to load itself suitably and equally *from the bottom*, and to carry afar the material desired to be removed from the channel.

With the same amount of steam power, but used in a very different way and with very different implements, a surface full twenty-five or thirty times as great, per hour, may be plowed and stirred sufficiently, and from three to ten times the amount of earth be removed, and removed much farther, and the channel can be worked much deeper.

Yet it appears that no machine for dredging has ever yet been used in which the mode of work and implements for working were in full adaptation and harmony with this great natural

*So far as mere *amount* of an hour's work is concerned, this amount would be enough to do all that is or was required.

force—*a force still reposing as unnoticed and unused* as steam and electricity so long reposed, even after being known, before being rightly harnessed, and utilized to supply man's ever increasing wants.

By the use of this great power, and by the means herewith described, and fully adapted to the mode of work, the inventor can show the ability to remove much more than is required at the mouth of the Mississippi, and give complete and easy command over any earth-obstructed channel-way of navigation, by use of a steamer of same power, as the McAlister. And the plan of steamer and implements are adapted to meet varied circumstances of difficulty, and work to a sufficient depth for the heaviest ships that float; whereas, those dredges could only work down to a depth of about eighteen or nineteen feet, and could only work under the most favorable circumstances.

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## STEAM AND AQUATIC FORCE* CHANNEL SWEEPER.

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FOR IMPROVING COAST AND INTERIOR NAVIGATION. INVENTED BY WM. T. STACKPOLE. PATENTED BY W. T. STACKPOLE AND HON. ALLAN A. BURTON, OF LIVINGSTON COUNTY, ILLINOIS.

This invention is designed to be used in harmony with natural forces, and the latent power of water to take up, hold suspended, and remove earthy material, and form and re-form channels, coasts, &c.

The whole weight and momentum of the steamer and all her equipment; plows, beams, paddle-wheels, &c., act in harmony with this latent power reposing in the water itself, and which is CALLED INTO ACTION BY MOTION—both the motion produced by these artificial appliances, and the motion of currents, tides, waves, &c., if they exist, and can be used to advantage.

But even in a perfectly still, tideless and waveless lagoon or lake, and where there is not the least current, the steamer can

*Believing this a new force in this proposed practical application, I have taken the liberty of giving it a name.

both plow and produce sufficient motion to secure very ample results, in plowing and sweeping out and deepening a channel-way.

On the other hand, in a current, or amid waves, the proposed dredging steamer and her intended equipment, are believed to be adapted particularly to operate with great and rapid effect, even upon a firmly impacted bottom, the plows being adapted to sand, mud, clay, or even gravel.

This harmony with Nature's earliest recorded force, is believed to be much nearer complete, and the adaptation of the artificial implements for the needed work much more practical than that of the dredging apparatus used in Europe or America. And hence it is believed to be, if rightly handled, adequate to the reasonable and sufficient improvement of most of the natural channel-ways of navigation in our own and other countries, at a comparatively moderate cost, and with widely beneficent results.

## THE PLOW.

This implement was the first to come uppermost in the mind of the inventor, and very careful and faithful examination since, (for nearly five years) leads to a full belief that it is a *reliable subaqueous plow* for coast or interior work, in water deep or shallow, on the various kinds of earthy deposit, and that can be used amid currents or waves, and adapted to different classes of steamers.

Nearly all the plowing done upon land, is still (as of old) done with a man holding the handles of the plow, and this even in America and Europe. This is because of its certainty, economy, and adaptation to all manner of varied conditions. So with one simple form of axe; the product of many ages is found adapted to chopping all kinds of trees. Hence, it must be apparent that successful and extensive plowing *under water*, in coast and interior waters ranging from 1½ to 30 feet or more in depth; on uneaven bottoms, of various kinds of earthy deposits, including many obstructions and with various conditions as to currents, waves, &c., —requires and must have *a sure and simple instrument*—one adapted to these various requirements, and that can safely be depended on, when out of sight, to meet many difficulties and overcome many embarrassing circumstances.

It must be adapted to effective regular service, in *practical working gangs*, to justify the use of a steamer; and it must be an implement that will, when properly drawn upon with a rope or chain, adjust itself in position and remain so, without being held and guided by a man as on land. Moreover, it must be adapted to a speed above that of the plow-horse on land, when desired, in order to obtain the largest results in great and heavy work on a clear bottom, where the steamer can readily move at the rate of five or six—or probably in some cases, even eight miles per hour. The simple COMBINATION, which it is believed gives the desired implement, is entirely original with the inventor, but the seperate implements which he has thus combined, are very old in agriculture and navigation. They are the eye, stock, shank and a shortened arm of the anchor; but instead of the "fluke," to hold, a steel shovel is applied to plow, similar in shape to that used on the common, old shovel-plow; probably the oldest and simplest form in use.

It is believed that this combination, in connection with the full ability (elsewhere) to hold the separate ropes or chains (to which each plow is attached independently of the others) in a proper position and suitable angle, even in *very deep* water, together with the peculiar adaptation of the connecting mechanism, not only meets all these requirements fully, and in a simple form, but also this plow and its entire connections will work both ways with equal facility; thus being perfectly adapted to a superior steamer that shall work *forward and back*, over a shoal or bar, by merely reversing the motion of her paddle-wheels (exactly amidships) *without "rounding" and turning the vessel about.* (This leads on to a whole set of great and important, and peculiar advantages that are claimed as connected with the peculiar construction of the steamer the inventor has planned as most suitable for these modes and appliances, but which need not be here enumerated.)

By avoidance of rounding and turning about in plowing and sweeping a channel, or in grappling and clearing it when required, not only can much time be saved, but the steamer can *hold her position under difficulties*, instead of drifting far away while rounding and turning about, as she would be sure to do when con-

tending with wind, waves, currents or tide. At such times a steamer of ordinary construction, no matter how well handled, could only regain her position and line of work with great difficulty and much delay, even in clear daylight. But in darkness or mist she could not work at all. In other respects, also, there would be a loss in practical results in rounding and turning about (as required by other designs for sub-marine and sub-fluvial plows), even under the most favorable circumstances. Besides this advantage each plow is applied independently, and the connections are flexible; and rigid and inflexible gangs of plows can hardly be said to have yet succeeded, even on land.

## THE FOUR BEAMS.

FOR PLOWING, STIRRING, GRAPPLING, ETC.

The arrangement of two of these large beams (and auxiliary mechanism and equipment equally complete and thorough) at each end of the steamer, is such as to not only afford ample facilities and power for rapid, safe and effective work, but also to give easy control over all the various operations for which they are designed, both in examining, raking and clearing the bottom, and in deepening the channel. Each beam and connection works independently of the others, and hence they can be used singly or all at once. While this arrangement is carefully adapted to easy change of position, and varied work, and is of great strength and power, yet it is comparatively simple. And an important point, frequently wanting in the most elaborate and costly mechanical apparatus, is the degree of *flexibility* given by the spring cushions, at the ways and blocks, where the large arms join the rock-shafts. This, in effect, corresponds with nature's provision, where the human arm joins the shoulder; or with the flexible shoulder of the animal that draws the plow on land.

This flexibility, while in no way detracting from the strength and effectiveness of these particular parts, or of the general mechanism, must very greatly lessen, to all, the force of any sudden or violent strain, shock or jar, and contribute largely to the smoothness, regularity and efficiency of all work, and greatly diminish all risks of breakage and accidents.

Capt. Elwell, of the U. S. dredge boat McAlister, informed

the writer, (when visiting the work at Pass a l Outre, La., in July, 1875,) that his vessel would often be very violently jarred from stem to stern by the digger coming in contact with a firmly impacted bottom, and that no strength of machinery could prevent many damaging and expensive breakages. Of course almost every one of these would terminate the service of that powerful steamer until it could be repaired. And under that plan no remedy was possible, and no skill or care could avert these disasters and delays.

Yet great and beneficent results were gained by the vessels, (the Essayons and McAlister), and while work at the mouth of the Danube has been lauded as highly successful and useful, yet the results obtained there by means of "jetties" cannot justly be considered better than those obtained by means of these dredging steamers at the mouth of our great river. For while a depth of about twenty feet was obtained at the Sulina mouth of the Danube; yet a shoaling above, left—at extreme low water—only thirteen feet (13 feet) available for ships to enter the main river, (as per Sir Charles Hartley's statement), being greatly less than obtained by work of the U. S. dredging boats at the mouth of the Mississippi. In addition to this, these powerful steamers could, and did, render most important and valuable service to vessels needing assistance in crossing the bar.

The precise measure of success gained by Capt. Eads at the mouth of the Mississippi by means of the jetties and dredging, (as at the Vistula) is not known to the writer, but like all other work at river mouths, thus far, cannot justly be claimed to be sufficient to meet the needs of commerce, but doubtless it is well worth its entire cost.

The accompanying cut* it is hoped may help illustrate the general plan of the proposed steamer as designed by the inventor, and in correspondence with his apparatus and mode.

It may not be admitted that this mode is entirely new, but the writer as yet has seen no evidence of its full or suitable ap-

*The intention of illustrating by a cut was abandoned because of the necessary incompleteness of such illustration. And to give a number of cuts, and complete and minute details, would carry this little work far beyond what is intended or required. I was shown in the office of the U. S. Engineers, at New Orleans, a large volume of cuts, specifications, &c. of the U. S. Dredge McAlister, though her plan seems simple enough.

plication. Either "digging" or "scraping" are widely different operations, though sometimes referred to in published reports of engineers as "stirring." The work of the Essayons and McAlister was called by the officers in immediate charge of the work "digging" or dredging; and "mud-diggers" was the common term applied to those steamers in the vicinity where used, and where their utility was most highly and justly appreciated by competent and candid men; and it most fitly and clearly described the operation. So too the work done at S. W. Pass in 1852, by the Tow Boat Co., under direction of Capt. Thomas Snow, of Maine, was described to the writer by competent officers engaged in the work, as performed with *scrapers drawn by tow boats.*

It will be seen that this steamer and her appliances are designed to work in a *widely different manner.* The beams, from their position, and arrangement for easy and rapid raising, lowering and adjustment as may be desired, are peculiarly adapted for plowing, and also for grappling and removing such obstructions as logs, trees, snags, &c., &c., where they exist and impede the work; and the arrangement for stirring is complete.

All the authorities,—dredge boat officers, bar pilots, engineers, &c.,—seem to agree that no snags or logs have ever yet been found at the mouths of the Mississippi, (that is in the bars) but Capt. Snow in the progress of his work, was seriously annoyed, delayed and embarrassed by a sunken boiler from a towboat that had exploded on the bar some time before, it being a very difficult object to grapple, and he being unprovided with suitable means for removing so extraordinary an obstruction.

But with these appliances, such an object, though entirely out of sight, and in water 20 feet deep, (or even forty feet deep) could be readily raked for and found; and then loosened in its bed, grappled, and hoisted on board or into an attendant scow, in a very few minutes. And in many localities where there are no natural obstructions but mud or earthy material, doubtless old anchors, lost chains, &c., will be encountered. Again, where sunken wrecks are blown out of channel-ways (for which the powerful explosives now in use—exploded by electricity afford such splendid facilities) fragments might lodge in the way and

need to be quickly removed. And for all such service the raking and grappling gangs would be peculiarly adapted. And so too all four beams (if required) are constantly available for *stirring;* either close to the bottom, or at any point between the bottom and the surface of the water, that may be desired. And this too, even in very deep water, and all the beams and gangs acting in conjunction, and in full harmony with the movement of the steamer, her swell, &c.

## SIZE AND POWER OF STEAMER.

For a large coast steamer, for the heaviest service, say the harbor approaches of New York or Mobile, the mouths of the Danube or Mississippi, a steamer should be provided with a power equal to that of the McAlister, (say eighteen hundred horse power) but using a hull, say 275 feet in length by 40 or 42 feet beam, with side wheels, and say 60 feet in width from outside to outside of paddle-boxes. The two shortest beams would then be about sixty feet in length each, and the two longer ones about seventy feet each in length. Each beam should be about three feet in diameter at the center, tapering to two feet where joined to the arms; the arms being about 18x24 inches, with rock-shafts, blocks, &c., of a size and strength suitable for these dimensions. In ordinary service it is probable that the two shorter beams will be all that will be required, the others being held in reserve for use when required. If but a single line of plows is used in a gang, then 12 or 13 would be used in each gang. If two lines, then each gang might consist of 23 or 25 plows. The plows, (at a speed of say five miles per hour) could hardly require a power greater than that of two or three horses each. But if we allow even four-horse power to each plow, and four gangs of plows, each of two lines and twenty-five plows, and fifty-horse power for each beam in addition, all this plowing and stirring would only add six hundred-horse power to that required to drive the vessel's hull, leaving always a surplus of power.

Taken as a whole then, *this channel-sweep*, with four beams lowered in position for service, would form an implement fully three hundred feet in length by seventy feet in width; and fully

able to sweep a path over seventy feet in width, in water as deep as the deepest keel that ever crossed the ocean.

The longer arms and beams when not required for service, could be easily hoisted to a perpendicular, and lowered over the top of the smoke stacks, and brought to a rest with the beams upon the officers' cabin. This position would leave the main decks entirely clear; and with the other beams secured to and resting against the derricks, with their arms in a nearly perpendicular position, the steamer's equipment would be properly disposed of to enable her to make a sea voyage; while her capacity for carrying a supply of coal and stores would be very ample.

The McAlister, from her small hull and high build, could hardly be a very safe or pleasant vessel on a stormy sea voyage, while her capacity for carrying coal would be very limited. And so with the Essayons.

## WORK IN DEEP WATER.

This channel-sweeper is peculiarly adapted to effective work in a depth of water far beyond any dredging service ever yet attempted. And beyond the question of meeting the requirements of the commerce and shipping of modern times, lies yet another question, not yet broached by engineers, for the very good reason that no way had been opened to solve the first.

The faith of the writer in this means for the solution of one of the most pressing physical questions of the times, a question interlocked with vast and urgent needs on the one hand, and benefits on the other; this faith in this solution, has led to the consideration of the question as to whether, in some localities, great advantage might not be derived *from deepening some channel-ways much below the depths required for vessels to pass?* If the depth required be 28 feet for the approaches to a sea-port, and it be practicable to deepen the channel, ten or even twenty feet below that point, might it not be a wise economy to do so, where, by so doing, *under-currents* caused by various natural forces might be brought into play? That in *some* estuaries, bays, &c., this might be the case, seems quite reasonable, and also that sometimes important benefits might thus be gained.

That the arms of the channel-sweeping steamer can be held in a position to reach straight down, at right angles with the hull

of the steamer, can be clearly shown; and that while so held they can be used with effect in plowing, stirring, or grappling in water several feet deeper than the lower side of the beams, is also plain.

Of course it could not be expected that the steamer's hull should be driven at as high a speed, nor that so many cubic yards of earth could be removed per hour. But there seems no reason to doubt that a large and good steamer, under experienced officers, could perform highly effective work—under suitable conditions as to weather, &c.—*in water over fifty feet in depth.* Even at that depth, as well at any lesser depth, the arrangement of the arms and beams is such that they can be placed and held in *any desired position between the surface of the water and the bottom*, thus not only facilitating deep grappling and plowing, but enabling the *stirring* of a strata of water at the very bottom, if so desired, and found to be advantageous.

## THE PLAN OF STEAMER.

ITS GENERAL AND SPECIFIC ADAPTATION TO EXTENDED AND EFFECTIVE USE AND VARIED KINDS OF SERVICE IN IMPROVING AND DEEPENING CHANNELS—STEERING, HANDLING AND CONTROL.

The *plan of the steamer* is believed to combine varied and superior advantages for the service for which she is designed, some of which are also believed to be worthy of consideration for commercial steamers.

The *first* consideration with the inventor, was the *easy adaptation to reversing the motion*, so as to *sweep the shoal both ways* with equal facility, and without being drifted away from the position, and without losing time. This has already been referred to in connection with the *form of plow*, each being adapted to the other, and too much stress cannot well be laid on this forward and back motion—for the steamer—as its advantages are great indeed, and various as great. Reflection, however, will probably bring them before the mind of the reader, or engineer, more fully, and we will pass on to other points.

Foremost among these is the question of HANDLING, STEERING, AND CONTROL. Of course, it is well known that a *sufficient rate of speed is essential* to secure and maintain "steerage-way" and control the vessel. Hence any method or plan of work that

compelled a very low rate of speed for the steamer's hull, would greatly embarrass the whole matter of steering, handling and control of the vesel, and so, at least, very greatly diminish her efficiency and capacity for work, if it did not, also, lessen her safety. It would also unfit her to meet many difficult conditions and situations, and debar her from even attempting certain classes of work; for instance, a sea-coast bar, where she would be exposed to the force of waves, winds and tidal currents, all at once, or even separately. Yet these very forces can not only be met, but by the inventor's mode and equipment are intended to be utilized in gaining results.

The engineer under whose general direction the McAlister and Essayons worked, having conceded that a steamer with these new appliances could easily work at the rate of five or six miles per hour, in such work as that at either bar at the mouths of the Mississippi; and the most practical and experienced pilots having conceded that separate engines for the paddle-wheels would satisfactorily dispose of any difficulty as to steering, &c., the inventor could well afford to rest the case as to those points.

But it is believed that just examination will show, and practical tests confirm the claim, not only for sufficient power of control, &c., but superior, if not unequalled, advantages in these respects, not only over other dredgers, but over other forms of steamers. The paddle-wheels would be placed exactly amidships, and instead of being driven each by a separate engine, the driving power would be divided among four equal engines, two for each paddle-wheel, thus removing a whole class of troubles from engines getting "hung on the center," &c., or the possibility of it, and securing various advantages, especially in facilitating handling, turning, and general easy and certain control of the whole weight and power of the steamer and her equipment. And while no other form and plan of steamer could possess such facility for direct movement forward and back, so as the power on each side, as well as length to each end, would exactly balance, so no steamer upon any other plan, in these particulars, could possess the same facility *for turning about upon her own center*, and in the shortest possible time. Almost as a horseman could wheel a well trained steed, so the commander, or officer of the

deck, from his central position on the bridge, near the pilot, and over the engines, could order the power that would quickly wheel his steamer about, arrest her motion, or change her course. As the position of the beams and gangs, and their connections at each end of the steamer, are also balanced, the one by the other, so the use of these large beams as *stirring sticks*, when so required, would not seriously embarrass the steering and necessary control of the vessel's movement and position. But if at any time of difficulty, the beams in any given position below the surface of the water, were found embarrassing the steerage of the vessel, very seriously, they could, one or all, be raised in a moment, and then when required, as quickly lowered again, and placed in the desired position.

## THE PILOT HOUSE.

Many sea-going vessels are so constructed that the helmsman or pilot can only steer by compass or command, even in crowded channels, or where surrounded by land-marks and fixed objects, or moving vessels near. He must usually await orders as to his course, even if about to come in collision with another vessel, which perhaps he can only see imperfectly, if at all. In this respect it would seem that the western river steamers are superior to most other vessels in use, as the pilot, from his high perch, always has a commanding view. So under this plan, for river work.

For a steamer, planned for heavy sea-coast service, though not quite so *high* as for largest river work, yet the pilot has the same commanding view of surrounding objects, and that on all sides; and when he reverses the motion of the steamer, he has but to secure one pilot's wheel, and turning on his heel take the one at his back, not leaving his post a moment.

Widely different is it with the Essayons and McAlister, and serious must be the objections to any plan for a dredging steamer, when the pilot or helmsman, after crossing the shoal, must secure his wheel, and go to the other end of the vessel and take the other, leaving his vessel adrift, as it were, and without control. Of course when the motion is reversed, the rudder that has just guided the vessel becomes the cut-water.

## KEEPING THE STEAMER "TRIMMED" OR RIDING ON AN "EVEN KEEL."

Every practical and competent officer on boats or vessels on rivers, lakes or seas, knows that this is always a very important point in all navigation, always a matter of solicitude, examination, consultation and effort, and after the best that can be done many a craft must perform all or part of her trip, or voyage, a little "down by the head," a little "down at the stern," or a trifle "lop-sided." To all who have experienced these difficulties in practical navigation, the writer would beg to point out:

1st. That this proposed working steamer for improving earth obstructed channels, would *inevitably*, from her form and construction, be *perfectly balanced*, when placed in the water and completed, and ready to take her cargo.

2nd. That her only freight would be her coal, stores and implements, and that the consumption of coal would be in two sets of furnaces, equi-distant fore and aft from the center, and taking coal equally from fore and aft.

3rd. If the clerk and mates see that the same number of tons of coal are taken in forward, as aft, and properly distributed, that the vessel must always be about even, and a little care as to stores, &c., will *always keep her perfectly even without ever consulting her water marks.*

## SIZE OF HULL.

Among the many objections to placing a very great power on a very small hull, as in the cases of the U. S. dredging steamers referred to, a very serious one must be the inability to take on coal enough to last any considerable time. But the proposed steamer for heavy service on coasts, would have ample capacity to take on coal enough to cross the Atlantic, and perform effective service in Europe before again coaling. And her safety at sea would be fully equal to that of commercial steamers.

## QUARTERS FOR OFFICERS AND MEN.

In many commercial and war vessels the comfort and health of the men seems but poorly provided for, often through the necessity of making room for many persons, and much light

freight, and from other causes not always avoidable. And this discomfort and hardship is sometimes fruitful of evils, and often tends to make necessary a rule of force, or an arbitrary and severe rule, rather than a just pride in the faithful performance of duty by all on board, from the lowest to the highest, and prompt and cheerful obedience of orders by all. On some vessels even the captain and officers can hardly be free from almost constant discomfort, and the accommodations of the men are poor indeed.

The size, peculiar duties, and general arrangements of this vessel, and her cabins, are such as to easily admit of good and suitable quarters for all, with due provision for comfort and health. Should it be thought by experienced builders and navigators that the position of the officers' quarters, above the deck cabin, made it objectionable or unsafe in event of a sea voyage being required, it can be so constructed as to admit of being taken down and stowed away until the voyage is accomplished, and then re-erected. But its central position, between the paddle-boxes, and limited size, it is believed would render this unnecessary.

### WHEN A SEA VOYAGE IS REQUIRED.

The two longer frames should be hoisted to a perpendicular, and then lowered over the tops of the smokestacks and brought to a rest on the cabin deck, and here secured by suitable lashings to guard against the ship's lurching. The two shorter frames should be brought to a nearly vertical position, resting firmly against the derricks, and there suitably fastened by lashings. In this position the beams, if so desired, might be used to attach sails, thus enabling, at times, the saving of many tons of coal, for use on arrival at distant working ground.

### FOR INTERIOR SERVICE.

The general plan and arrangement of the power, hoisting frames, plows, &c., would be much the same on a steamer designed for such service as the rivers of the Mississippi system, as for sea-coast service, but of course the hull would be much lighter, and not deeper than ordinary western river boats. And, as on them, the engines, boilers, &c., would be on the deck; this covered by a "boiler deck," with cabins above that.

For low water, and for the small upper rivers, a steamer should be of the same plan, but smaller, and lighter, with a lighter equipment. But in times of flood or high water a boat of the larger class could go up and render most effective service, in such localities as "Naples flats" on the Illinois, in deepening a channel, and elsewhere in sweeping away small bars if necessary. There are now completed on the Illinois two locks and dams. Above these there will be probably a slight deposit of sediment, which in time may need removal. If so, it could easily be effected by a steamer plowing and stirring in time of flood, or at even medium high water. The earth could, also, if desired, be taken up in buckets, and deposited behind piling, or for filling for any desired purpose.

## LIFTING FROM THE WATER IN BUCKETS.

Though this form of work is distinct from that for which the steamer and equipment is designed, yet the arrangement of the beams and frames affords facilities for large results, should such work be required of her. The *extra* equipment for it, would consist of a supply of buckets of light boiler iron, of suitable size, and whose length would be, say, thrice their diameter. They could be either square or round, fitted with bails at one end, and a hinge bottom at the other. These should be attached to the beams in even rows. The beams can then be suitably depressed, and the buckets filled by drawing them along the bottom by the steamer. When filled, they would, if all four gangs were raised at once, cause a heavy strain. To avoid this, their tops can be raised to the surface when filled, and the steamer proceed to the place for emptying without lifting from the water. Arrived at the place, one gang can be lifted and emptied at a time, and this rapidly, and the process repeated. But such service is regarded by the inventor as of *minor importance*, as compared with the greater service of sweeping channels, and a more full utilizing of natural forces, in accomplishing results of greater magnitude and importance, and not seemingly to be reached adequately by any means yet in use, and for which this is peculiarly designed, and believed to be peculiarly adapted.

## SOME GENERAL NATURAL CONDITIONS IN CHANNEL FORMATION AND IN PROPOSED IMPROVEMENTS AND METHODS.

Any one desiring to test the great, inexhaustible, and endless power reposing in water, to take up, hold suspended, and remove earthy material, and form and re-form channels, shores, and coasts, can easily do so with a large tank of water in which is some sediment such as is found in the natural channels of navigation. Of course, any smaller vessel will do, and a common water pail may be more convenient.

It will be seen that while the water is motionless, and at rest, it has no power to remove any part of this sediment, though of course, it may hold in solution and suspended an infinite number of minute particles that may or may not be visible to the naked eye. But let us stir the water and loosen the sediment at the same time, and soon a quantity is taken up and held suspended in the water ready to be borne away to another place if the water is poured out or emptied.

Thus this great primal instrument of the Creator is illustrated in geology throughout the globe, and is plainly visible on all coasts, islands, and shores, and in the earthy banks, bars, and shoals, of every river and creek,—for all are its work.

So all natural channels being formed by the water itself, (which never pauses completely in its work, as its task is never completely finished,) surely nothing can be more reasonable than that the superincumbent water on the shoal should be the chief agent in reducing it, or in improving a channel, or in aiding it to re-form to a slight extent, so as to leave less obstruction to navigation—or no obstruction.

From the annexed table, the amount of work expected of this channel-sweeper may be seen. And its *capacity for work is very great*, and believed to be amply sufficient for the very heaviest service required. [See table on page 9.]

And with some, the question will at once arise, "will not such immense quantities of earth fill up the channel elsewhere and ruin it?"

But let it be borne in mind that this earthy material is not brought from the land and thrown in the channel; it is there all

the time, and we are simply aiding or *forcing a change of position*; and when plowed and stirred and set afloat by the steamer, it does not merely change position *in* the channel *only*, and all lodge in the deeper places. In rivers, much of it, if not the most of it,—in many cases, nearly all of it—is borne *out of the channel*, and in its new position assists in earth formations that usually will improve the channel, and often will permanently assist in keeping it deeper.

Doubtless, in many situations, such as Mobile Bay, and various coast localities, these new formations induced by this channel-sweep, will become ridges, and act as jetties are expected to, but often much better, as man cannot equal nature in engineering water-levels and banks, or coast formations. We attempt to use her water-level when we take a straight piece of wood, and in it fix a tube containing a liquid. This we call a "spirit-level," and a most useful and necessary instrument it is. But what an imperfect trifle it is, when compared with the instruments and elements of nature, that extend throughout our rivers, and belt "the great globe itself," and so nicely level its waters, that the Suez Canal leads from sea to sea without lock or fall.

At the Sulina mouth of the Danube, engineering works or jetties increased the depth of water on the bar from twelve or thirteen feet, to twenty or over. But above, in the Sulina branch, a shoal formed, it now appears, on which at low water there was only thirteen feet. And so at the South Pass of the Mississippi. But the dredges never caused a shoal above, at S. W. Pass or Pass a l Outre, *because the natural level of the surface never was changed.* So it would seem altogether reasonable, and safe to assume, that sweeping out a channel over a bar or shoal at a river mouth—or in a river—will not tend to cause a shoal above, as in the cases where jetties have been built by engineers, and the natural flow of waters confined before their intended channel was deepened, or bed prepared.

But in submitting and explaining the claims of this mode and implements, it is not the intention of the inventor to engage in discussion of these vexed questions. For he has been told *long since*, by an eminent opponent, that "if this machine would do the work claimed for it, that it would work a complete revo-

lution in the whole science of engineering as applied to improving channel-ways." And while the model and specifications were being prepared for the U. S. patent, an eminent gentleman of superior information, then in Washington, wrote him that "the need of such a machine was as great in Europe as here, especially in the north of Europe." Hence the object in this communication has been to present those claims as clearly as practicable by such means, in the hope of securing just and practical tests, which he feels quite sure will then lead to those great and beneficent results which are now so urgently needed, and the need of which must constantly increase, both in our own and other countries.

The building of the Essayons was an experiment, justified by necessity, and good results were won, as her work and that of the McAlister was successful to a great degree. So, also, the jetties, built by Capt. Eads, have added to his high reputation as an engineer, and are worth all that they have cost. So, Sir Charles Hartley was highly honored by England's Queen for his work at the Danube. So, Russia, Prussia, and France, have indicated their wishes and their needs.

But the needed measure of success has not yet been won in a single case, while the work required is but begun. And mankind needs that work. And may we not reverently hope, that the Great Architect of the Universe will permit these humble labors to finally succeed. The admirable motto of the U. S. engineers is "Essayons," (we will try.) Its application by Gen. McAlister, or the board, or chief, to the first great U. S. dredging steamer, built for the mouth of the Mississippi, expresses a volume in a word. And a noble word, truly. But may it not be permitted now, to so amend it, that it may read,

WE WILL ALL TRY.

Should this be in effect allowed, might we not be all permitted to add—in hope and faith—yet another word, and the welcome, ardent, French word, "Encore," so that it will read when Americanized,

WE WILL ALL TRY AGAIN.

And let us hope that the sentiment may ever be kindly applied to all the rightful labors and pursuits of peace, and just fulfillment of those duties on earth required of man to prepare him for a brighter and better existence, when labors here are ended.

# APPENDIX.

## OUR HOME NAVIGATION AND STEAM TOWING.

THREE GRAND NATURAL SYSTEMS,—EACH OF ITS KIND UNEQUALLED ON EARTH, AND DESIGNED FOR UNITING, CONNECTING, AND BLENDING THE RESOURCES OF THE STATES ON THE COAST AND IN THE INTERIOR.

While it is a perfectly well-known fact that heavy shipping cannot yet enter the rivers, it is astonishing that men claiming to be great engineers and statesmen are urging theories of steamship navigation to St. Louis, &c., &c.

One member of the Illinois Legislature recently advocated before that body the urging upon Congress the task of "making the Mississippi and its tributaries navigable for steamships."

And while this folly goes on, there are upon the southwest boundary of Illinois, between St. Louis and Cairo, the wrecks of over five thousand boats, of various kinds, (see appendix to U. S. Senate Com. report,) caused by collision with snags or wrecks. By nature there was *no* dangerous obstruction, except the trees or logs that fell or floated in, and which an irregular and inefficient service failed to remove, and afterwards failed to remove the wrecks they caused, or such of them as obstructed the channel. These startling facts are very old, and well known to many, and were in evidence several years ago before a select committee of Congress. So, too, it is, or should be well known, that the Great Lake and Mississippi systems, are the great natural organs of our country for its inland transportation, and that *their full utility cannot be reached without* a suitable connection, via the Illinois River and canal, which that committee *actually omitted* from their special recommendations A most remarkable omission, truly. Yet this would be a work of comparatively moderate cost, and was begun over fifty-five years ago, and from the first was intended to be on a larger scale than it is, ninety feet on each side having been reserved for the purpose of widening it.

But though the whole Northwest has been in a large degree CUT OFF, (by neglect to clear that part of the river on southwest boundary of Illinois, and complete this connection) from the benefits of this navigation, and so has suffered a peculiar local injury, in addition to the general injury common to all the States, yet the high art of river navigation by steam, first illustrated to the world in our country, has continued to advance toward perfection; and now,

in economy and efficiency, far surpasses any navigation or transportation the world has ever seen.

It is on the Ohio (and thence to New Orleans) that the great economy of steam towing has been brought to its highest and best development, and by men who have never been accused of corrupting the government of their country or States by bribery. With a single tow boat, costing no more than a first-class locomotive, and light, cheap barges, they sometimes bring down convoys, bearing twenty-four thousand tons, or what would load six or eight large steamships, or fifteen miles of railroad cars. They annually transport down the river about four millions of tons of coal, at an average cost for freight of about one-third the cost of ocean freights from our Atlantic ports to English ports per ton per mile. In making this estimate I have used the Senate Committee's tables of ocean freights on grain, making an average for the ten years from 1863 to 1873, and average the coal freights as given in evidence at Cincinnati.

Now *can it be possible* that the practical bearing of such conclusive and mighty truths cannot be discerned? If they have been obscured from any unfortunate cause, or the gifts of God to our country denied, or hidden through errors, is it not high time that we acknowledged them to Him, and make a practical application of the gifts, by taking out the snags and wrecks, and completing this connection (between the rivers and lakes) so that all the people of this country can have the use of them, as the Great Architect of our dwelling place on earth intended.

And this action will not only recognize in a right way that wise and beneficent plan, but will also be concurrent with, and a proper fulfillment of the organic law of our Northwestern States, as set forth in the ordinance of 1787.

Not only is steamship navigation to St. Louis an absurdity (or worse), as shown by reason, and the established facts of all practical navigation, but the best results in heavy transportation on these waters do not require great depth of water. Convenient barges, drawing, when full freighted, not over six, or at most, seven feet, have been and will continue to be better than unwieldy, heavily built hulks, drawing from eight to twelve feet. All can be of cheaper and lighter build when the snags and wrecks are kept cleared out. And if by supernatural power, the river and its tributaries were made fifty feet deep, heavy, costly, sea-going vessels could not come up against the current, and compete successfully with light, cheap river boats in freighting, as all practical men will admit. Why then waste the lives of another generation on such idle vagaries, omitting, meanwhile, an efficient, permanent service for removing snags and wrecks?

The venerable Richard P. Morgan, Sr., the oldest civil engineer of our country, said years ago, that "the failure to remove these obstructions was not only inexcusable, but disgraceful." And if we look abroad over the world, we will see that no nation has ever yet overcome the disadvantages of a wide interior, and maintained that degree of high civilization and advancement to which this country cannot justly aspire without its navigation, and that wisely and soundly developed—both inland and ocean. And to lift the heavy burthens now upon all the country, we need a wise use of every resource of nature and art we possess. The railroad men should bear in mind that the great convoys of barges

moving on the rivers, cannot vault over the land and take away their business! On the contrary they will be benefited, as will ALL, in ways that would require a volume to set forth, even in slight detail.

Nowhere on this globe is the evidence of its adaptation to highly civilized man's varied wants more conspicuous, and of design to provide therefor more clear, than in these arrangements for navigation. It is written in the many fine harbors of New England, the nursery of our ocean navigation; in the sheltered line, adapted for steam-towing, along our Atlantic and Gulf coasts, needing but little more to be made available from Southern New England to Western Texas —uniting all the sounds, bays, rivers, harbors, estuaries, &c. of both coasts, and receiving the outlets of the great lake and river systems of the interior by the Hudson and Mississippi, and uniting them also. It is written in the river system, reaching from the Appalachian to the Rocky Mountains, and in all that vast reach interrupted by only one rapid (that at Louisville,) from the Yellowstone to the Alleghany, and with not a single obstructing rapid from the Gulf of Mexico to Keokuk, or from the Gulf up to the Rocky Mountains. It is written in the noble group or chain of lakes, on the north, that stretch their southwestern arm out to, and almost touch the Illinois, so that LaSalle passed from one to the other on his memorable voyage.

On these three vast systems, all the varied and wonderful economies of steam-towing should at once be allowed to develop and unfold their benefits throughout the Atlantic, Gulf Coast, and Interior States. Everywhere the grandeur of the preparation God has made for us is plain. And the slight work required of us to come into possession is equally plain. And if our statesmen or our politicians love their country, as they profess, why cannot they discern its natural features? Why waste time on so many vast, needless, impracticable schemes, and allow the Illinois and Florida canals, and plain work on rivers, to go unprovided for? W. T. S.

# NAVIGATION:

THE

RIGHT HAND OF COMMERCE.

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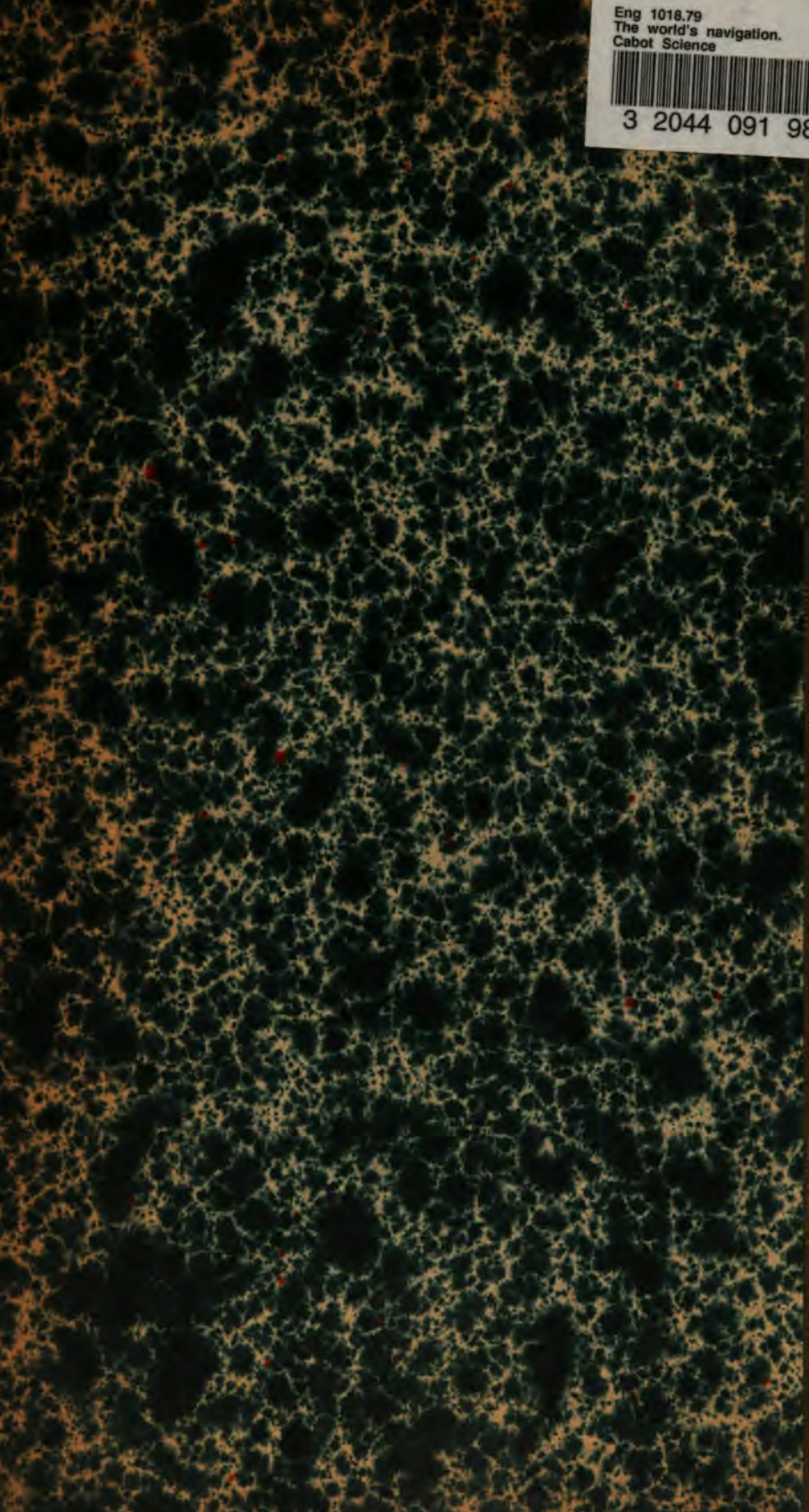
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